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DEVICE FOR CONTROLLING POWER DISTRIBUTION TO SUBSYSTEMS

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Inventor: BARTON BRUCE (US)
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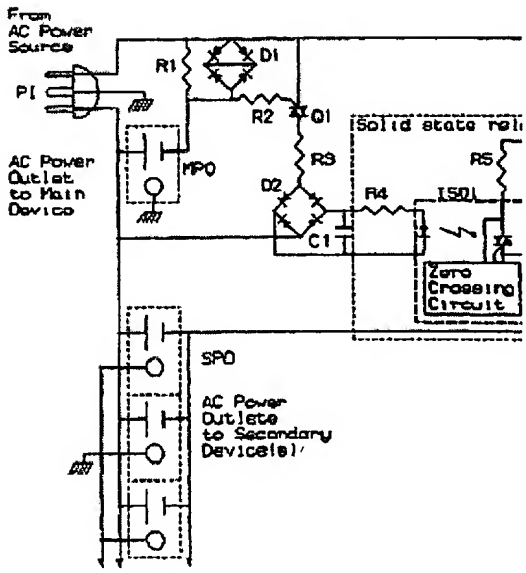
Also published
US6528

Cited documen
US48251
US5256
US5120
US4054
US5541
more >>

Abstract of **WO0167199**

A device for controlling power distributions to subsystems comprising a power input (P1) to be connected to a power source and a primary power output (MPO) and a secondary output (SPO) operated in response to operation of the primary power output (MPO).



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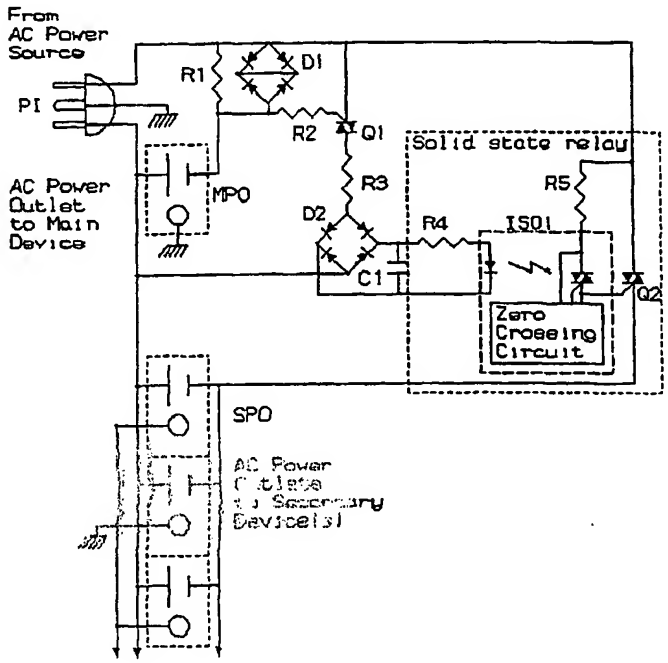
(54) Title: DEVICE FOR CONTROLLING POWER DISTRIBUTION TO SUBSYSTEMS



(57) Abstract: A device for controlling power distributions to subsystems comprising a power input (P1) to be connected to a power source and a primary power output (MPO) and a secondary output (SPO) operated in response to operation of the primary power output (MPO).

WO 01/67199 A1

Device For Controlling Power Distribution to Subsystems

Technical Field

The present invention relates to devices for controlling a distribution of power to subsystems, for example to a main device and at least one secondary device or a plurality of secondary devices.

More particularly, the present invention relates to the above mentioned devices formed as electrical power strips and power control sensors which can be used with new devices having two modes of operation, standby or off and full on, with the use of main device or secondary devices.

Background Art

One type of an electrical distribution device is the power strip or power control center, which generally comprises of a row of power outlets, switched or unswitched, to distribute power to a primary device and secondary device(s) from a standard outlet (e.g., wall outlet). Some power strips and control centers contain options like circuit breakers, fuses and/or surge protectors, for example.

In newer personal computers the system can turn itself off and is controlled by the operating system. During the system shutdown, there is a delay in which the operator must wait for the system to finish before turning off the secondary device(s). Depending on the operating software and programs, this can be a long time. Using this invention, the user may leave after the shutdown is started. When the system finishes and switches off or to the standby mode, the secondary device(s) will be turned off.

When used with computer devices, each device is plugged into a separate outlet with the computer plugged into the main outlet. When the

computer is turned on, the current level increases to a high enough level to turn on the secondary device(s). Other constant pow outlets may also be included for wake up devices, such as modems capable of bringing the system out of standby mode.

U.S. Pat. No. 4,659,941 discloses a power strip where the main outlet current controls the secondary device(s) as shown in Fig. 2. Here, the secondary switch and trigger device are the same. In this configuration, the main device must draw current at the start of each cycle of line power for the triac to trigger correctly. With high efficiency supplies, this is never the case because they only draw power during the peak voltage of the line power. So, when used with a PC or newer video/audio equipment, the voltage to the secondary outlets will not be a sine wave like the voltage from the wall outlet. This waveform can damage the secondary device(s). The second problem is personal computers and newer video/audio equipment do not turn off completely, but remain in a standby mode so they can turn themselves on at a given time or occurrence. Because of this, the secondary device(s) will never be turned off, defeating the purpose of the power strip's use.

U.S. Pat. No. 4,731,549 and U.S. Pat. No. 4,970,623 are methods for controlling secondary device(s). Both require internal power supplies and many components, making them too expensive for mass production and difficult to fit in a standard power strip.

Description of the Invention

Accordingly, it is an object of present invention to provide a device for controlling distribution of power to subsystems, which avoids the disadvantages of the prior art.

In keeping with these objects and with others which will become apparent hereinafter, one feature of present invention resides, briefly stated, in a device for controlling a power distribution to subsystems which has a power input to connected to a power source, a primary power output to be connected to a primary device, at least one secondary power

output to be connected to at least one secondary device; sensing means for sensing when a current level falls below a threshold in response to the primary device being turned off and when the level current raises above a threshold in response to the primary device being turned on; and executing means operatively connected with said sensing means and operative for interrupting a power supply to said at least one secondary device when the sensing means sense the current level below the threshold and supplying power to said at least one secondary device when said sensing means sense the current level above the threshold.

In accordance with a further feature of present invention, the inventive device further has time delay means which is located between said sensing means and said executing means and is operative for delaying interruption of power supply or supply of power to the at least one secondary device in response to the sensing of the current level below the threshold or above the threshold by the sensing means correspondingly. The time delay means can be formed as a capacitor and resistors arranged between the sensing means and the executing means.

In accordance with a further embodiment of the present invention, the sensing means can be formed as a current sensing resistor arranged in series with a power input of the device and a triac connected to the resistor, for example through another resistor.

The executing means can be formed for example as a solid state DC relay, as an AC mechanical relay, as a solid state AC relay, etc.

The novel features which are considered as characteristic for the present invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

Brief Description of the Drawings

Figure 1 is a view showing a device for controlling a power distribution to subsystems in accordance with one embodiment of the present invention;

Figure 2 is a view showing a distribution control device in accordance with the prior art;

Figure 3 is a view showing the inventive device in accordance with another embodiment of the present invention;

Figure 4 is a view showing the inventive device in accordance with still a further embodiment of the present invention;

Figure 5 is a view showing the inventive device with a power source, a main subsystem and secondary subsystems;

Figure 6 is a view showing the inventive device in accordance with still another embodiment of the present invention;

Figure 7 is a view substantially corresponding to the view of Figure 6, but showing a modification of the inventive device of Figure 6;

Figure 8 is a view showing the inventive device in accordance with still a further embodiment of the present invention; and

Figure 9 is a view substantially corresponding to the view of Figure 8 but showing a modification of the device of Figure 8.

Best Mode of Carrying Out the Invention

A device for distributing power to subsystems in accordance with one embodiment of the present invention as shown in Figure 1 has a power input (PI) which is connectable to an AC power source. A current sensing resistor (R1) converts the current drawn by a main system or device connected to a main power output (MPO), into a voltage. The current sensing resistor (R1) is arranged in series with the main power output (MPO). Diodes (D1) are placed in parallel with the resistor (R1) to

limit the power to the resistor, by limiting the voltage on the resistor to two diode drops or about 1.2 volts. The diodes (D1) a placed in both directions because the current through the resistor (R1) may be alternating.

When the voltage across the current nsing resistor, created by the main device power level, exceeds the gate trigger voltage of the triac (Q1), a current flows through the gate protection resistor (R2) and the gate of the triac (Q1). Current through the gate of the triac(Q1) will cause the triac(Q1) to switch on. Current now flows through the triac (Q1), current limiting resistor (R3), and the bridge rectifier (D2) to charge the capacitor (C1). The current limiting resistor (R3) limits the current to the triac (Q1) and the bridge rectifier (D2) as well as forming a resistive capacitive time constant to slow down the charging of the capacitor (C1). This helps prevent false triggers as well as creating a turn on time delay for secondary systems system(s), if wanted.

The energy now stored in capacitor (C1) turns on a relay to control power supply to secondary power outputs (SPO), to which the secondary system (device) or secondary systems (devices) are connected. Even though a mechanical relay can be used, a solid state relay is preferred for reliability and because it can contain a zero crossing detector to help with the secondary surge turn on current. The energy stored in capacitor (C1) will keep the relay on during the times when triac (Q1) is off due to the non full wave current use characteristics of the main device. The energy stored in capacitor (C1) can also be used for full wave triggering of the secondary device(s) even when the main device uses only a half cycle of each full cycle of the incoming power and for creating a time delay when turn off power to the secondary devices.

In the solid state relay the current limiting resistor (R4) protects the optical isolator's (ISO1) input diode from the voltage on the capacitor (C1). When current from the capacitor (C1), through the resistor (R4), to the input diode of the optical isolator (ISO1) becomes large enough it will turn on the optical isolator (ISO1). The resistor (R4) also forms the turn off resistive capacitive time constant with the capacitor (C1) by limiting the discharge current. This allows the turn off time of the optical isolator (ISO1) and the secondary system(s) to be delayed.

The optical isolator (ISO1) may contain a zero cross detector to help with turn on surge currents of the secondary device(s) and help prevent noise spikes. The output of the optical isolator (ISO1) is connected to the gate of the triac (Q2). When the optical isolator (ISO1) turns on, it triggers the triac (Q2) supplying power to the secondary power outlet(s). With power now applied the secondary device(s) will now turn on. An optional protection resistor (R5) or fuse may be placed in series with the output of the optical isolator (ISO1) for safety.

In the above described embodiment the current sensing resistor (R1) together with the triac (Q1) constitute sensing means which sense a current level below or above a predetermined threshold, while the solid state relay constitutes executing means which, in response to the sensing of the current level by the sensing means interrupts the current supply to the secondary device(s) when the sensed level is below the threshold as a result of turning off of the primary device or supplies the current to the secondary device(s) when the current level sensed by the sensing means is above the threshold as a result of turning on of the primary device.

Figure 3 shows another embodiment of the inventive device. It substantially corresponds to the embodiment of Figure 1. However, in the device in accordance with the embodiment of Figure 3, the output of the triac (Q1) is connected directly to the relay. The relay can be a mechanical relay or a solid state relay.

Figure 4 shows another embodiment of the device in accordance with the present invention. In this embodiment the output of the triac (Q1) is phased shifted to drive the triac (Q2) directly. Here the current limiting resistor (R3) the capacitor (C1), the current limiting resistor (R4) and the second triac (Q2) together form a solid state AC relay.

Figure 5 shows the inventive device connected to an AC power source, the main device and the secondary devices.

Figure 6 shows a further embodiment of the device in accordance with the present invention. Here a mechanical current driven relay (RL1) is used to control the secondary device (S). When the magnetic field reaches a threshold determined by the mechanical

configuration of the relay (RL1), the relay (RL1) will close. When the relay (RL1) closes, it supplies power to the secondary device (S). The windings of the relay (RL1) are of a low impedance, so that the functioning of the primary device is not affected. For safety purpose, the windings should be able to handle the full rated current of the power strip. Alternatively, limiting protection devices can be used as shown in Figure 7. In this figure the limiting protection device includes diodes (D1, D2). The diodes (D1, D2) are placed in opposite directions because the current is alternating and must be limited in both directions.

Figure 8 shows a further embodiment of the present invention. This embodiment is substantially similar to the embodiment of Figure 6. The difference is that the current driven relay (RL1) is replaced in the embodiment of Figure 8 with a thermal relay that can be made with, for example, a bimetallic switch. The current drawn by the main device is converted to heat. When the heat reaches the threshold determined by the mechanical configuration (RL1), it will cause the relay (RL1) to close. When the relay (RL1) closes, it supplies power to the secondary device (S). Such an approach is better than the use of the magnetic relay, because a thermal device has an inherent time delay. The time delay in turning on and off the secondary device (S) will help prevent false turn ons and turn offs. As with the magnetic delay, the heating element should withstand the full current of the strip. Alternatively, as shown in Figure 9, power limiting devices like diodes (D1, D2) can be used again for the same reason as in Figure 7.

It is to be understood that the device in accordance with the present invention can be used on many different voltages, including but not limited to 100, 120 and 220 Vac, for domestic and international use.

Instead of the triac (Q1) transistors or other switching devices can be used. Also, separate diodes can be used instead of the diode bridges. The diodes (D1) also can be replaced by any voltage limiting device.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in device for controlling power distribution to subsystems, it is not intended t e limited to the details shown, since vario_ modifications and structural changes may be made without departing in any way from the spirit of the present invention.

\ .thout further analysis, the foregoing will so ully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

Claims

1. A device for controlling a power distribution to subsystems, comprising a power input to be connected to a power source, a primary power output to be connected to a primary device; at least one secondary power output to be connected to at least one secondary system; sensing means for sensing when a current level falls below a threshold in response to the primary device being turned off and when the current level raises above a threshold in response to the primary device being turned on; and executing means operatively connected with said sensing means and operative for interrupting a power supply to said at least one secondary device when the sensing means sense the current level below the threshold and supplying power to said at least one secondary device when said sensing means sense the current level above the threshold correspondingly.

2. A device as defined in claim 1; and further comprising time delay means which is located between said sensing means and said executing means and is operative for delaying interruption of power or supply of power to the at least one secondary device in response to the sensing of the current level below the threshold or above the threshold by the sensing means correspondingly.

3. A device as defined in claim 2, wherein said time delay means include a capacitor and resistors located between said sensing means and said executing means.

4. A device as defined in claim 1, wherein said executing means includes a DC relay.

5. A device as defined in claim 1, wherein said executing means includes a mechanical AC relay.

6. A device as defined in claim 1, wherein said executing means includes a solid state AC relay.

7. A device as defined in claim 1, wherein said sensing means includes a current sensing resistor arranged in series with said primary power output, and a triac connected to said resistor and to said executing means.

8. A device as defined in claim 7, wherein said current sensing resistor is formed so as to convert current into voltage; and further comprising means for limiting voltage across said current sensing resistor.

9. In combination with an electrical power source a primary device, and at least one secondary device, a device for controlling a power distribution comprising a power input to be connected to the power source; a primary power output to be connected to the at least one secondary device; sensing means for sensing when a current level falls below a threshold in response to the primary device being turned off and when the current level raises above a threshold in response to the primary device being turned on; and executing means operatively connected with said sensing means and

operative for interrupting a power supply to said at least one secondary device when the sensing means sense the current level belo' the threshold and supply power to said at least one secondary device when said sensing means sense the current level above the threshold.

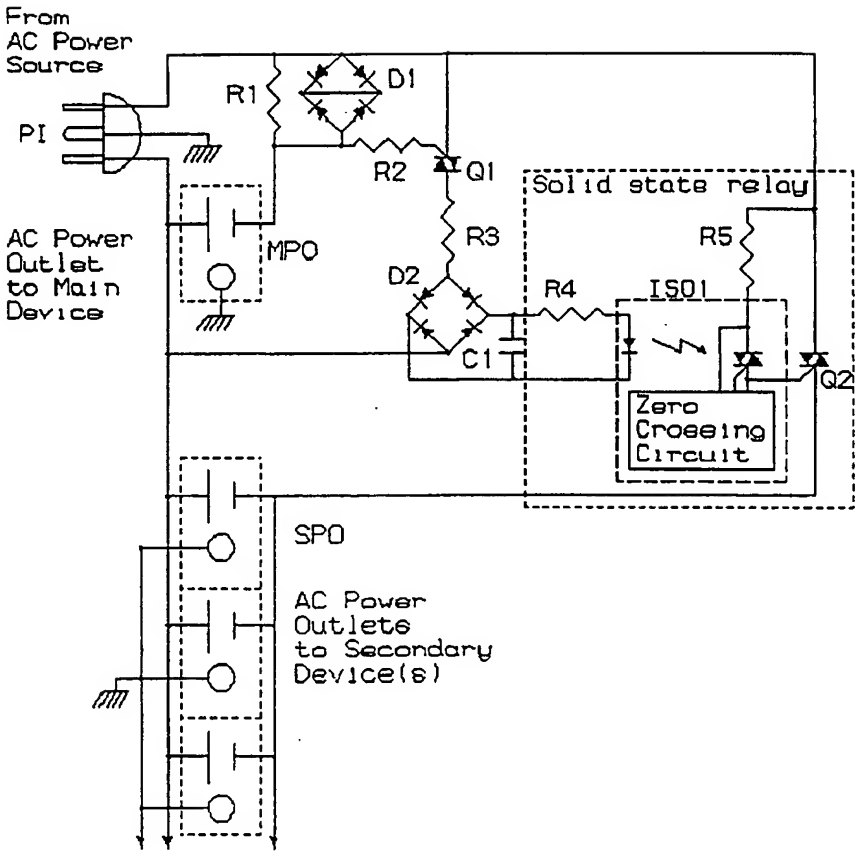
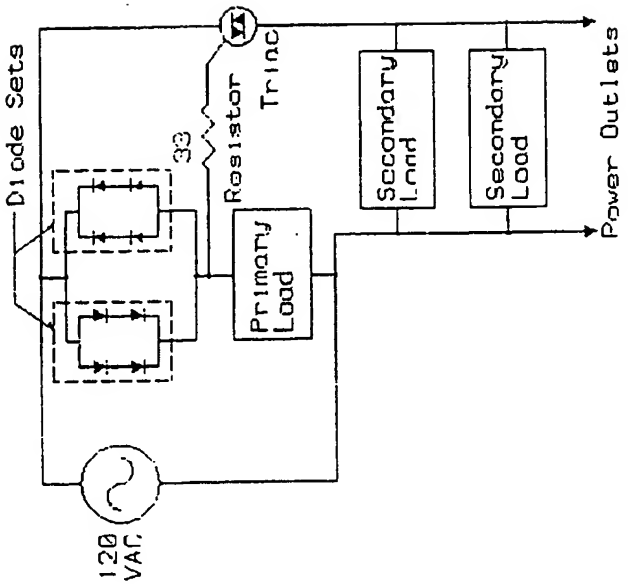

From
AC Power
Source
PI
R1
D1
R2
Q1
Solid state relay
AC Power
Outlet
to Main
Device
MPO
R3
R5
D2
R4
ISO1
C1
Q2
Zero
Croseing
Circuit
SPO
AC Power
Outlets
to Secondary
Device(s)

Figure 1



(Prior Art)
Figure 2
Patent 4,659,941

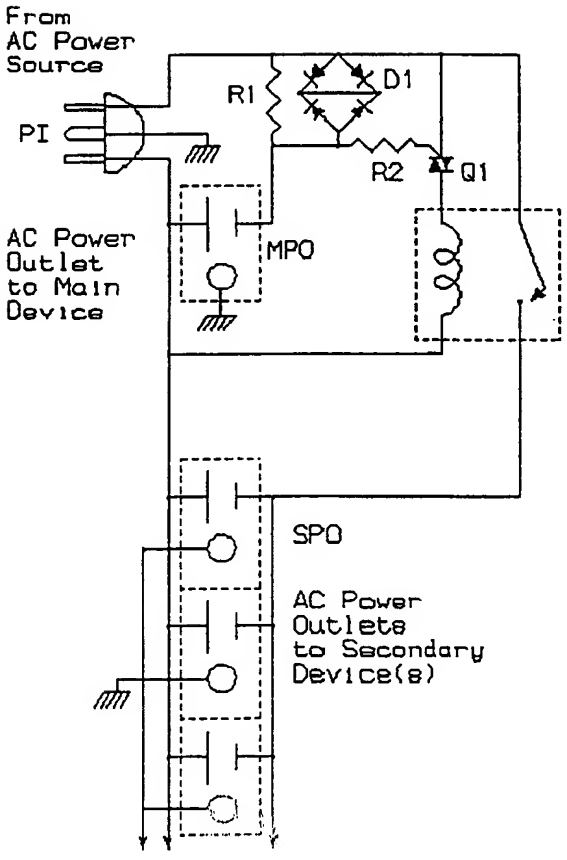

From
AC Power
Source
PI
R1
D1
R2
Q1
AC Power
Outlet
to Main
Device
MPO
SPO
AC Power
Outlets
to Secondary
Device(s)

Figure 3

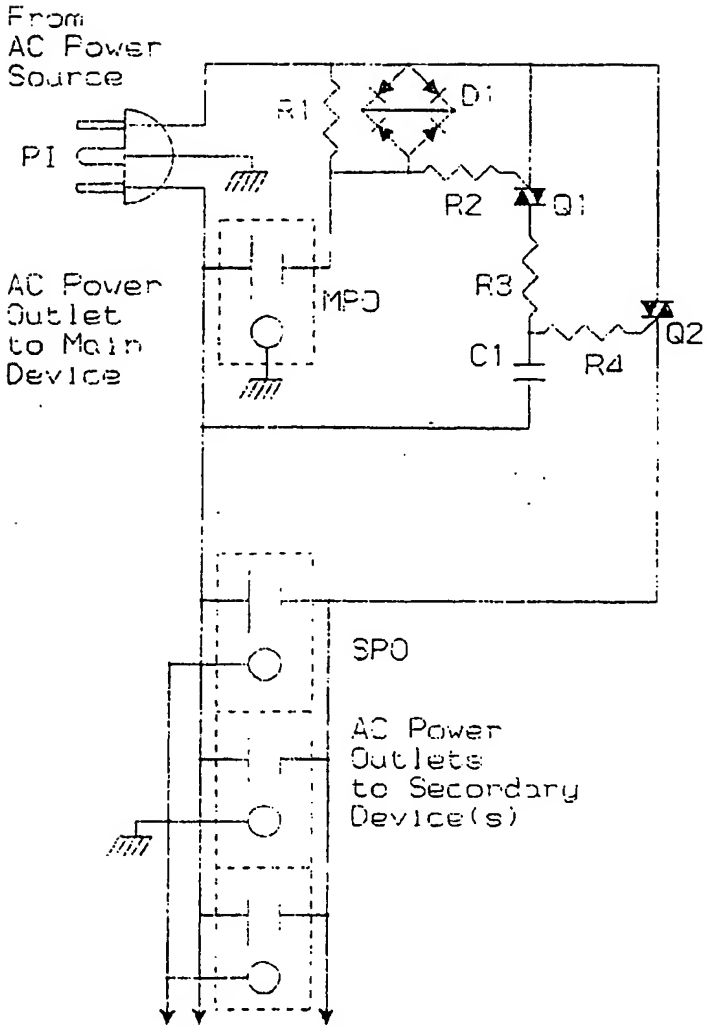

From
AC Power
Source
PI
R1
D1
R2
Q1
R3
Q2
C1
R4
AC Power
Outlet
to Main
Device
MPO
SPO
AC Power
Outlets
to Secondary
Device(s)

Figure 4

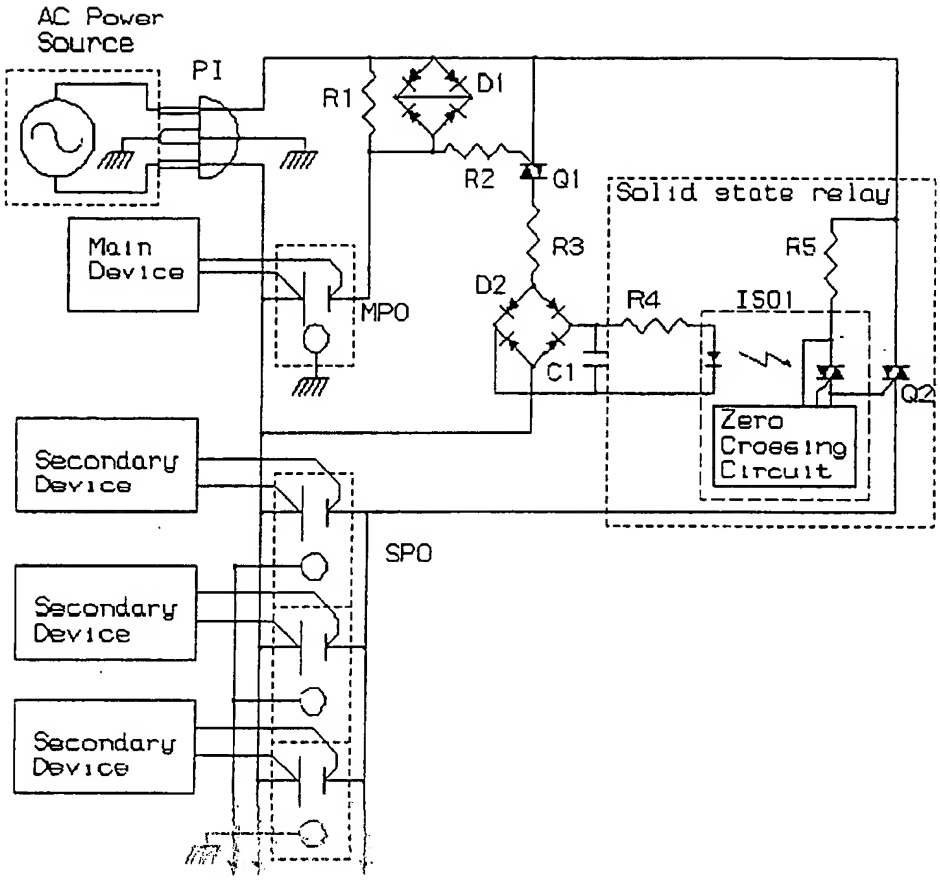

AC Power Source
PI
R1
D1
R2
Q1
Solid state relay
R3
R5
Main Device
D2
R4
ISO1
MPO
C1
Q2
Zero Croesing Circuit
Secondary Device
SPO
Secondary Device
Secondary Device

Figure 5

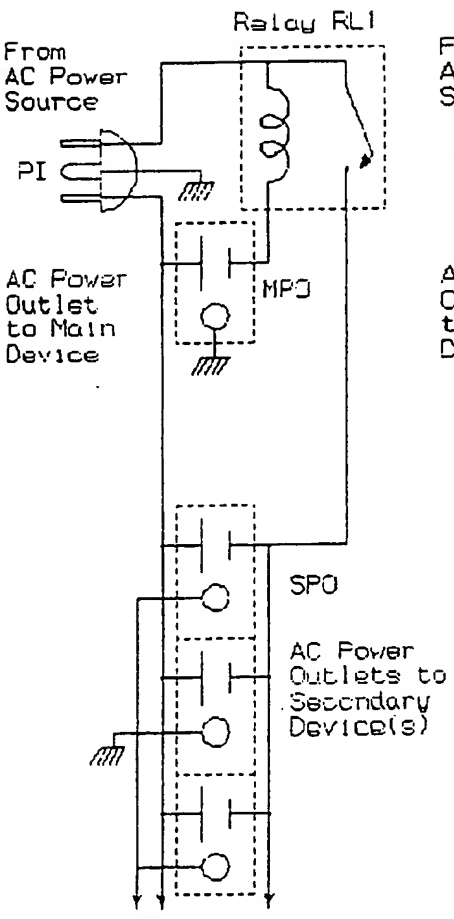


Figure 6

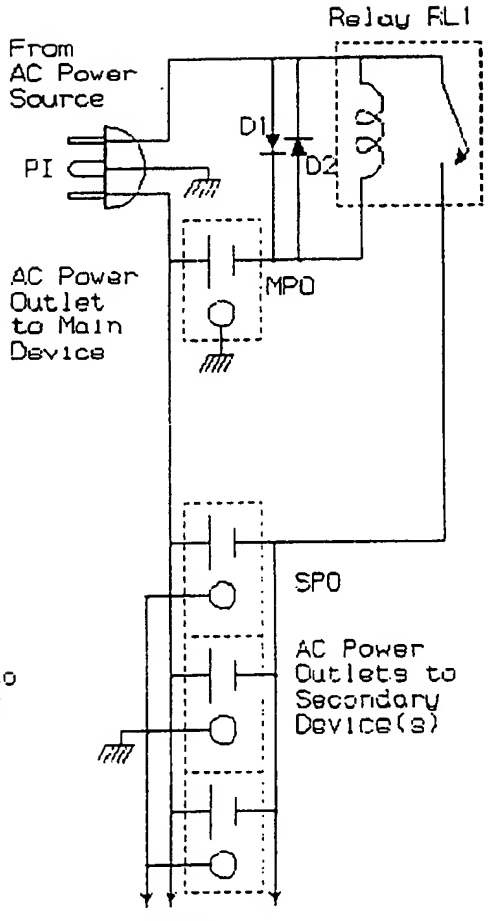


Figure 7

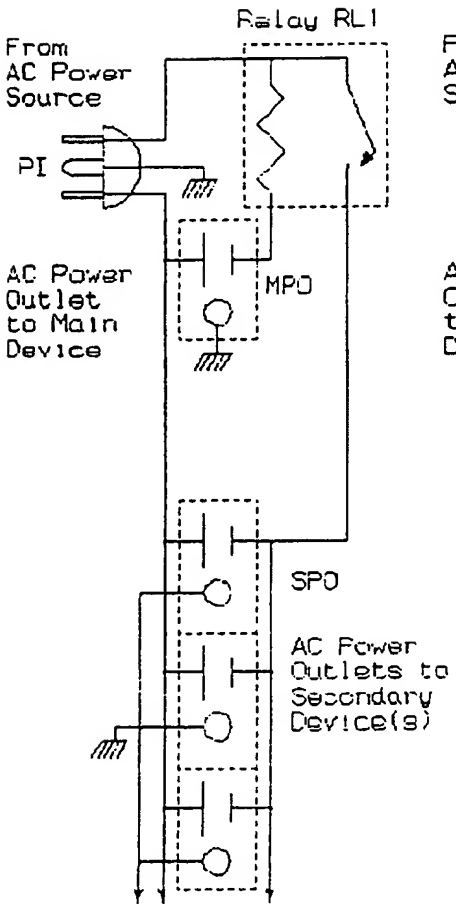


Figure 8

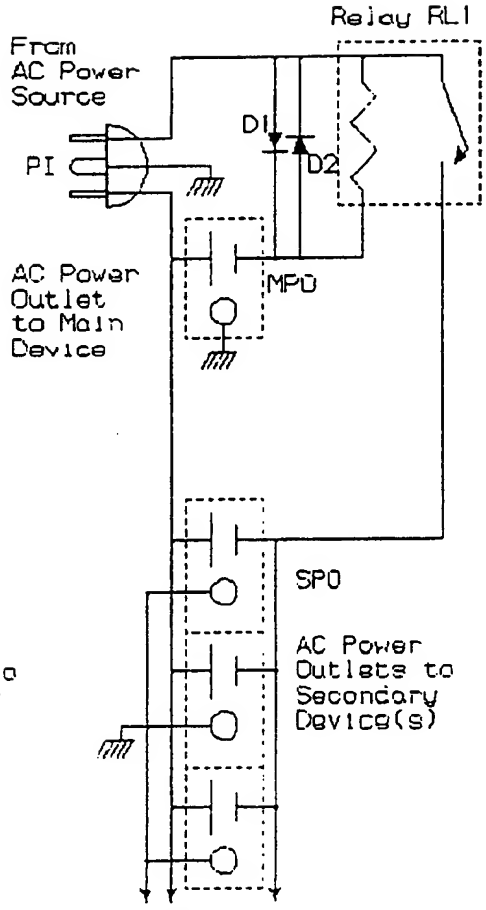


Figure 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/10306

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) :G05F 01/10
US CL : 307/39
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 307/39

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST: slave and master and triac.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US, A 4,825,140 (ST. LOUIS) 25 APRIL 1989 (25/04/1989), SEE ENTIRE DOCUMENT.	1-3,6,7,9 --- 4,5,8
Y	US, A, 5,256,906 (TSUGE ET AL.) 26 OCTOBER 1993 (26/10/1993), SEE ENTIRE DOCUMENT.	4,5,8
Y	US, A, 5,120,983 (SAMANN) 09 JUNE 1992 (09/06/1992), SEE ENTIRE DOCUMENT.	4,5,8
Y	US, A, 4,054,802 (MOCK) 18 OCTOBER 1977 (18/10/1977), SEE ENTIRE DOCUMENT.	4,5,8
Y	US, A, 5,541,457 (MORROW) 30 JULY 1996 (30/07/1996), SEE ENTIRE DOCUMENT.	4,5,8
Y	US, A, 5,270,576 (KAHLE) 14 DECEMBER 1993 (14/12/1993),	4,5,8

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 02 JUNE 2000	Date of mailing of the international search report 13 JUN 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer FRITZ FLEMING Telephone No. (703) 308-1483

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/10306

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5,563,455 (CHENG) 08 OCTOBER 1996 (08/10/1996), SEE ENTIRE DOCUMENT.	4,5,8
Y	US, A, 5,955,791 (IRLANDER) 21 SEPTEMBER 1999 (21/09/1999), SEE ENTIRE DOCUMENT.	4,5,8
Y	US, A, 5,731,947 (HIROSE) 24 MARCH 1998 (24/03/1998), SEE ENTIRE DOCUMENT.	4,5,8
Y	US, A, 3,416,001 (FISTELL) 10 DECEMBER 1968 (10/12/1968), SEE ENTIRE DOCUMENT.	4,5,8
Y	US, A, 5,099,157 (MEYER) 24 MARCH 1992 (24/03/1992), SEE ENTIRE DOCUMENT.	4,5,8